

Invasive Plants, Adaptive Sampling Early Detection Protocol

Standard Operating Procedure (SOP) #6: Data Collection and Entry

Version 1.00 (February 2010)

Revision History Log:

Previous Version	Revision Date	Author	Changes Made	Reason for Change	New Version

This SOP explains the process for collecting data in the field, uploading the data to the project database, and validating and verifying the data. Prior to implementing this SOP, you should have already read and followed the processes outlined in SOP #4: Setting up the Electronic Field Equipment. You should also be familiar with SOP #9: Databases.

Responsibilities

It is the responsibility of the Crew Lead to make certain field crews have all necessary equipment and field forms to help when collecting data. The Crew Lead should work closely with the Data Manager to develop a 1-2 day training session on how to use the data collection equipment. It is the Crew Lead and field crew members' responsibility to follow all validation and verification process when collecting data.

Understanding ArcPad

Field data collection for this protocol is done using a mobile mapping technology. Trimble Pocket PCs with ArcPad are used to record information while in the field. This information is then loaded into a Microsoft database, where it goes through validation and verification processes and is eventually loaded into the master database. In order to be able to properly collect the data while in the field, field crews will need to understand the basics of ArcPad. This section provides some of the details about the tools available in ArcPad. Field crews will gain a more in-depth knowledge of this hardware and software during the 2-day training session (SOP 3: Observer Training).

The ArcPad project that is used for this project has three main toolbars: the main toolbar (Figure 1), browse tool bar (Figure 2), and the drawing toolbar (Figure 3). The main toolbar is used to open or save a project, create a new shapefile, add shapefiles, set the properties of shapefiles, activate the GPS, set the properties of the project, and provide some general help. Figure 1 details the general features of this toolbar.

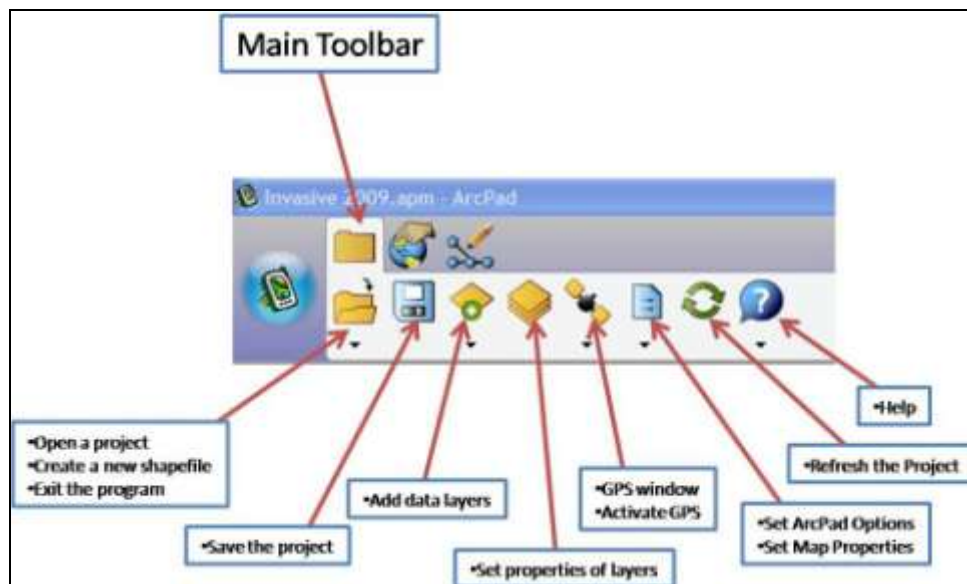


Figure 1. Description of functions available in ArcPad using the main toolbar.

The browse toolbar is used to navigate around the map. The tools available in this toolbar allow you to zoom in and out, pan, zoom to a previous view, identify an item, find an item, measure a distance, set a bookmark, and clear a selected feature. Figure 2 details the general features of this toolbar.

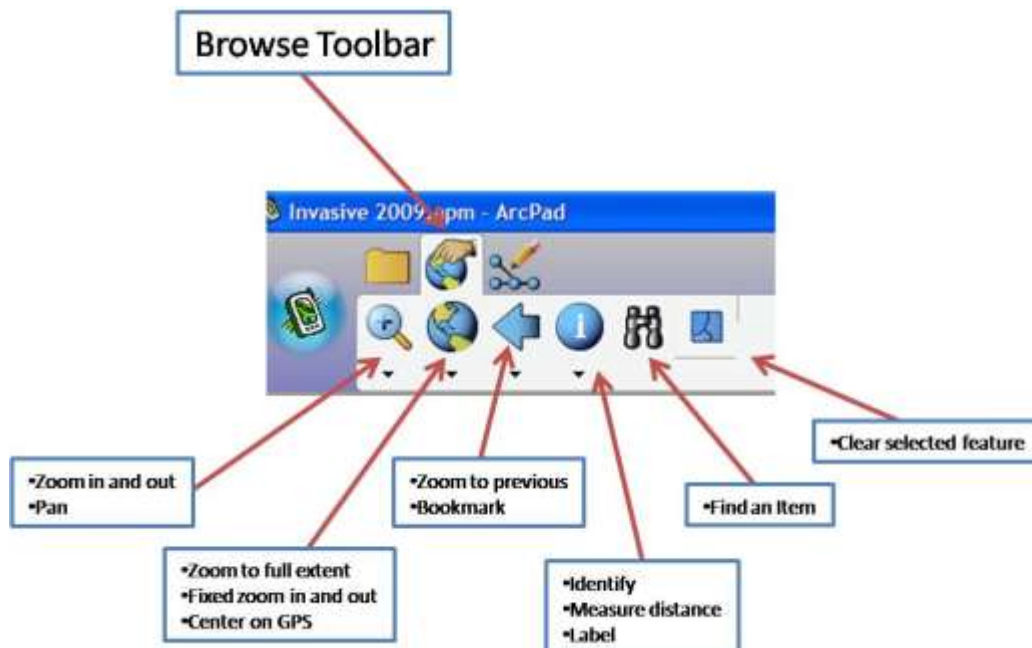


Figure 2. General features available on the browse toolbar in ArcPad. The drawing toolbar is used to select shapefiles to edit, draw a feature, capture a GPS location, offset a GPS location, and edit the attributes of a feature. Figure 3 details the general features of this toolbar.

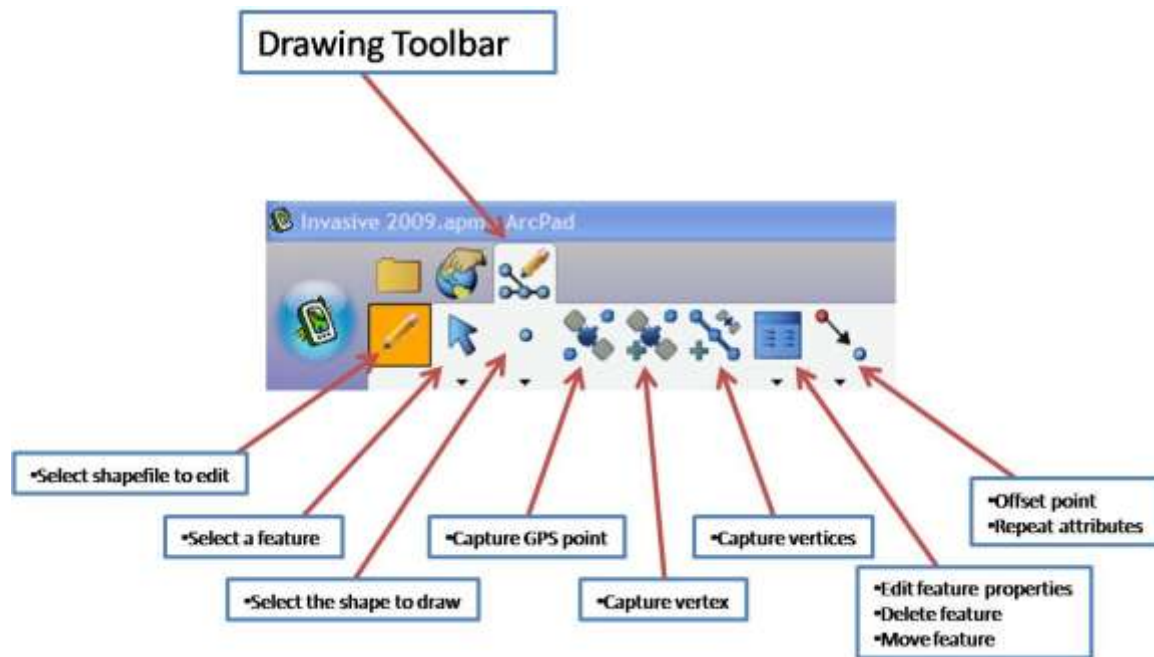


Figure 3. General features available on the drawing toolbar in ArcPad.

Data Collection

Now that you know the basics of ArcPad, you are ready to collect data. Once you have navigated to the start of the site you are surveying, you should follow the steps listed below to collect the project data.

Opening the Project File in ArcPad

- A. When you arrive at the start of the site, turn on the Trimble unit by clicking the [green] button on the bottom of the unit. If the cover page shows general contact information, tap anywhere on the screen.
- B. Tap the word [GPS] at the bottom, right side of the screen.
- C. Be patient while ArcPad opens.
 1. The program is set up to directly take you to a list of projects, select [**Invasive XXXX.apm**] from the list where the “XXXX” is the current year (Figure 4). Once selected, click the [GO] button at the bottom of the screen.
 2. If the list of projects does not open, go to step D. If you were able to select the project, go to step E.

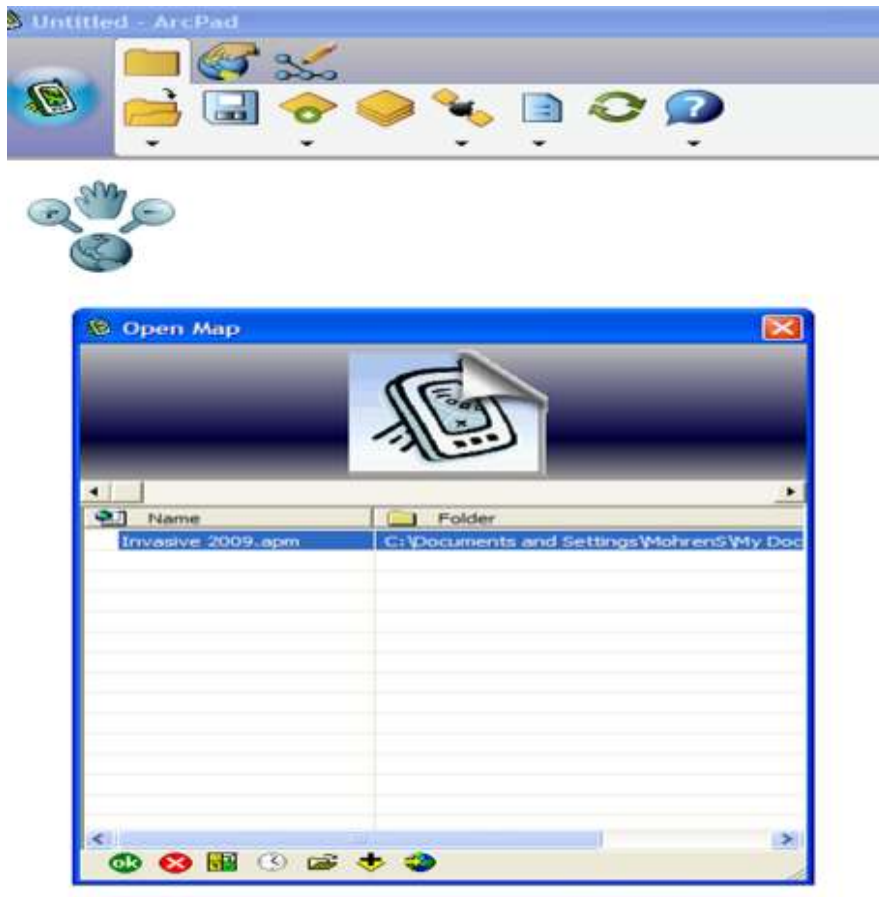




Figure 4. Selecting the project file on the Trimble unit to begin entering data.

- D. If the list of projects did not open, then you will need to manually find and select the project by following the steps below.
 1. Tap the small arrow next to the [] button at the top of the screen.
 2. Tap [Open Map  Open Map...].
 3. You should see the Invasive_XXXX.apm file, Tap the file twice to open it.
- E. When the project opens, it should have loaded the data shapefiles and background shapefiles (roads, trails, start points, etc.). In addition, the GPS should already be turned on and the unit should begin acquiring satellites. If it does not, you will need to activate the GPS by following the steps below and looking at Figure 5.
 1. under the satellite icon, select [GPS ACTIVE]

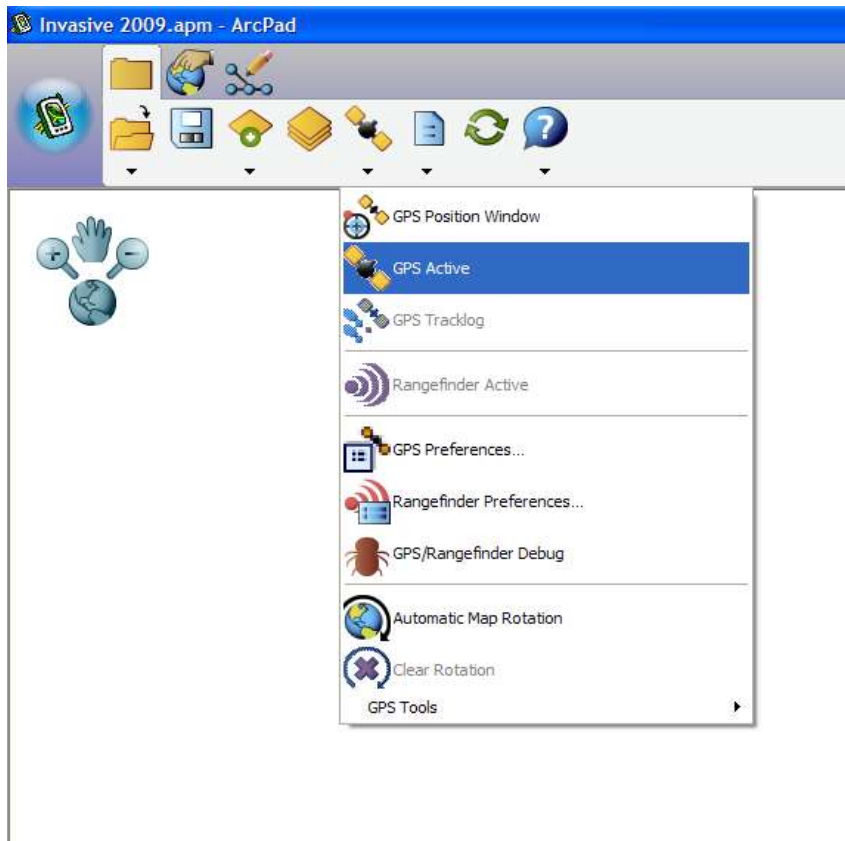



Figure 5. Activating the GPS unit so it will begin to acquire satellites.

F. Now you can add the background imagery. Note: You do not need to do this step; it is personal preference whether you want to use imagery or not.

1. Tap the [**Layers** - 2. Open the Image file and check the images you want to add. Please note it is the responsibility of the Crew Leader to ensure these files are available.
- 3. Once you have checked the files, tap the green [**OK**] button at the bottom of the screen.
- 4. Tap the [**World**] button to zoom to the park boundary.

Recording the Start Date and Time

A. When you are ready to begin surveying the route, you will need to record the start time. To do this task, follow these steps.

1. Zoom into the beginning of the route you are about to survey.
2. Under the drawing tool, activate the “DateTime.shp” shapefile by taping the shapefile under the start/stop editing tool (Figure 6).
3. Once you have selected the DateTime shapefile select the “Capture Vertex” button and chose [**Point**].

4. Using the stylus, draw a new point as close to the start of the transect as possible. Please note, this point does not need to be precise and time should not be spent making it

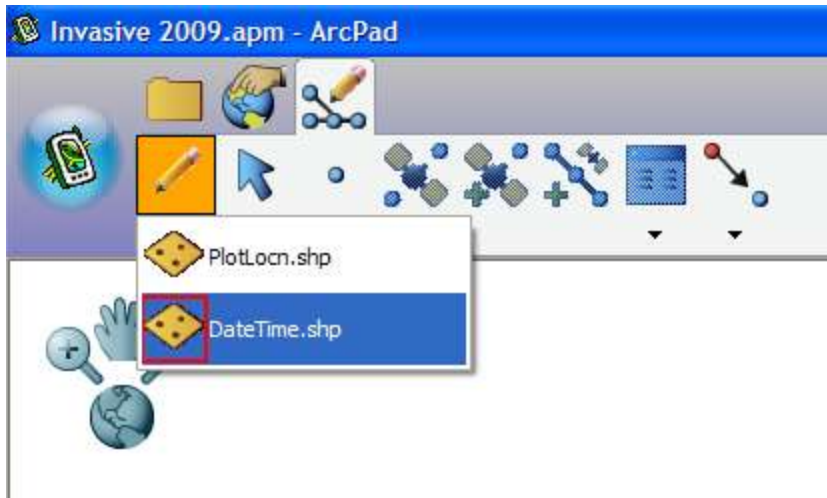


Figure 6. Activating the DateTime shapefile so you can enter the start and end date and time.

5. When you enter a new point, a form should open (Figure 7). This form has three tabs which need to be populated. To populate this form, follow the steps below.
 - a. Using the pick list, enter the name of the [**Park**].
 - b. Using the pick list, enter the name of the [**Route**].
 - c. Click the Date/Time tab at the top of the screen.
 - d. The day one start date should be automatically populated with today's data. However, you still need to check the box next to the date or use the dropdown arrow which will open a calendar and allow you to enter a different date.
 - e. Enter the starting time in military format with no colons (e.g., 0825, 1215, 2244).
 - f. Click the green [**OK**] button at the bottom of the screen. Do not worry about the end time or the Day Two information. This is discussed later in this document.

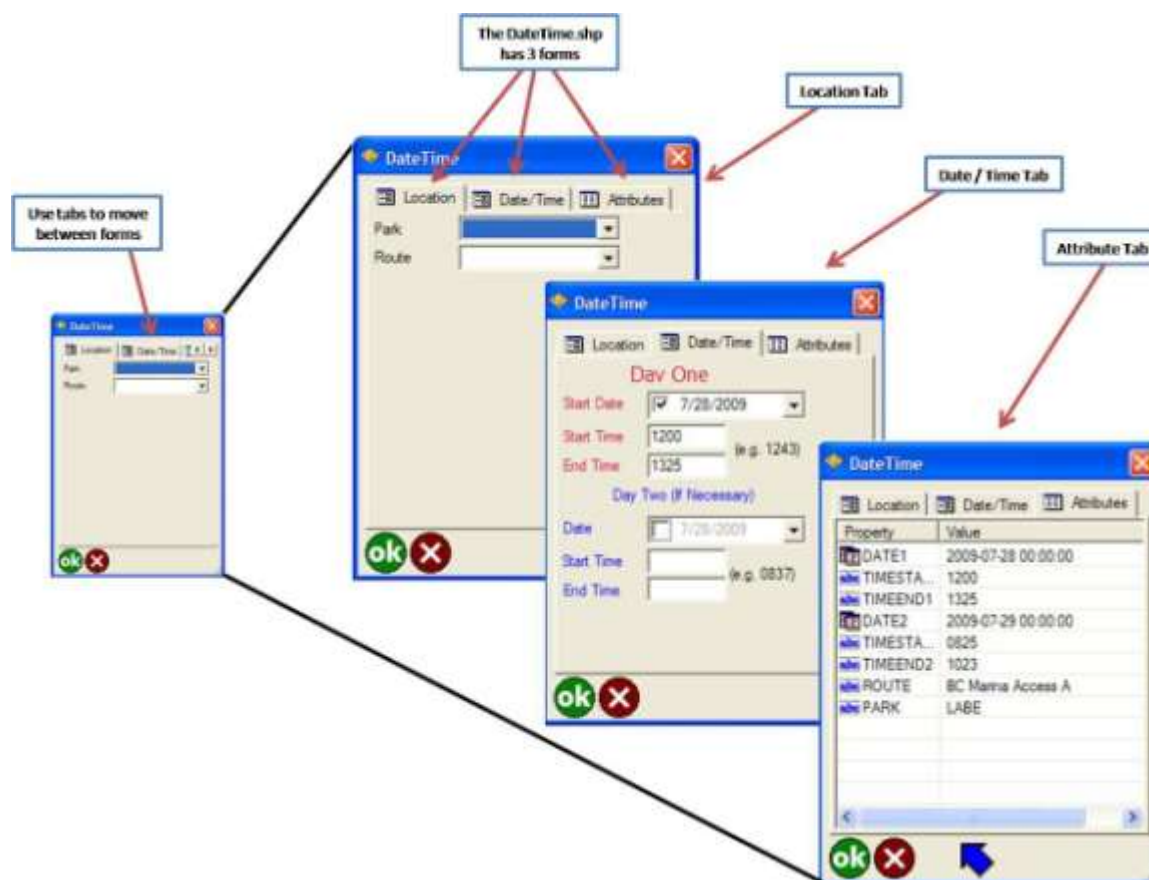


Figure 7. Forms associates with the DateTime shapefile. These forms are used to record the survey date and survey start and end times.

Beginning the Survey

- B. You are now ready to start searching for invasive species. Hike along the trail and when you come to an invasive species, complete these following steps.
 1. Select the [PlotLocn.shp] shapefile using the same methods as described in Step 2 under the Record the Start Date and Time section of this document.
 2. Walk into the middle of the infestation and tap the [**Capture GPS Point**] button under the Drawing Tool (Figure 3). This will open up a form that contains six tabs that will need to be completed (Figure 8). This form is only partially completed at this time. To complete this form, follow these steps.
 - a. Using the pick list, select the [**Route**] you are sampling.
 - b. Using the pick list, select the [**Segment**] where the species was found.
 - c. Select the [**GPS unit**] you are using to record the location information. Note: See the “GPS Capture Issues sections” below for information on EPE fields.
 - d. If the Trimble has satellite coverage, the [**PDOP**], [**Latitude**], and [**Longitude**] fields will automatically populate when you close the form.
 - e. Select the Species tab and use the pick list to enter the [**Encounter Class**]. There are two possible values:
 - (a) Infestation = A weed location
 - (b) Random = A random plot

- f. Use the pick list to enter the [**Vegetation**]. There are two possible values:
 - (a) Yes = Vegetation data was collected at this site.
 - (b) No = Vegetation data was not collected at this site.
- g. Using the pick list, select the [**Species**] you have observed.
- h. Using the pick list, select the dominant [**Phenology**] of the invasive species. There are eight possible options.
 - (a) Bolting
 - (b) Bud
 - (c) Dead
 - (d) Flowering
 - (e) Mature
 - (f) Rosette
 - (g) Seed Set
 - (h) Seedling
- i. Using the laser range finder, enter the [**Distance**] from the route to the center of the infestation in meters.
- j. Estimate the [**Size**] of the infestation and use the pick list to enter the appropriate size. There are three size classes.
 - (a) <1 square meter
 - (b) 1-25 square meters
 - (c) >25 square meters
- k. Select the CREW TAB and use the pick list to enter the name of the person recording the data on the Trimble unit.
- l. Use the pick list to enter the next most qualified crew member under the [**Crew 1**] field.
- m. Use the pick list to enter the next most qualified crew member under the [**Crew 2**] field.
- n. Skip the habitat tabs and select the TREATMENT TAB. Enter Yes or No if the site was treated.
- o. Since you have not done your random selections yet, set the [**Randomly Selected**] field to NO.
- p. Click the ATTRIBUTE tab and review the information you entered. This is one of the validation steps the crew is responsible for and should not be glossed over.
- q. Once you have reviewed the information, click the green [**OK**] button at the bottom of the screen.
- r. You can now move on and search for more infestations. Repeat this process until you have reached the end of the survey.

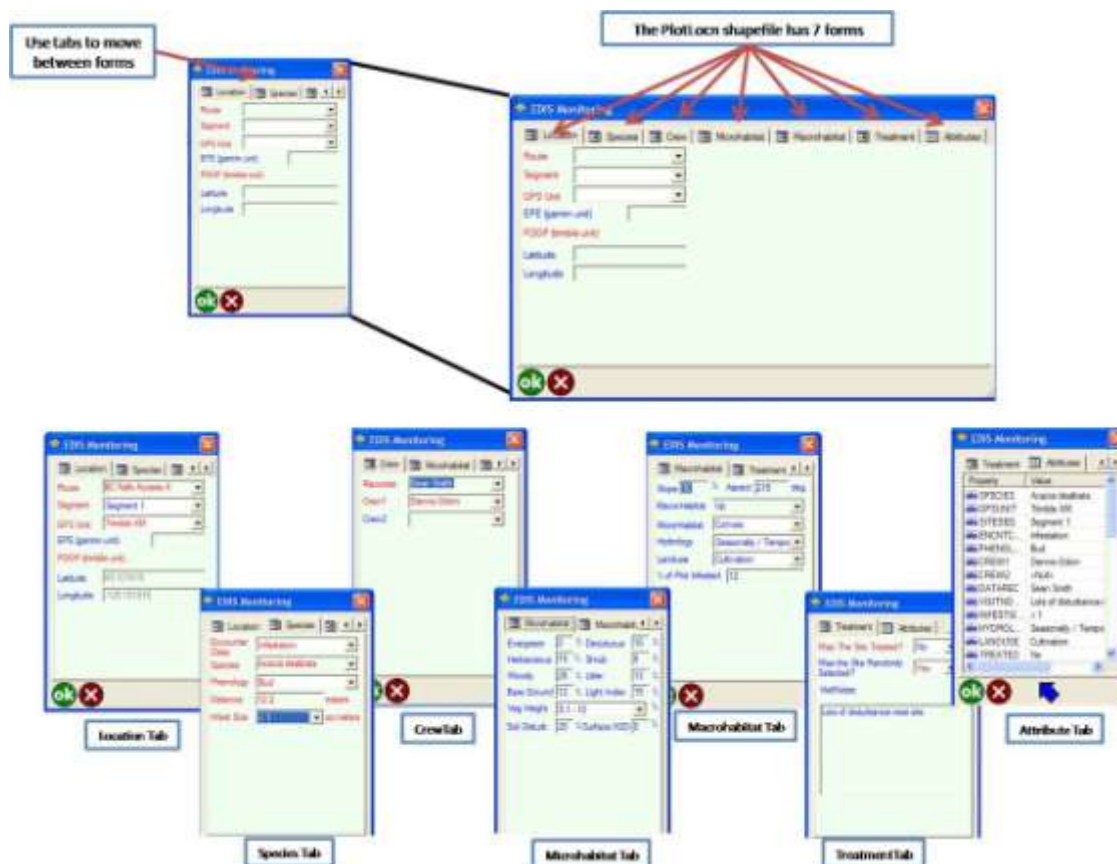


Figure 8. Forms associated with the PlotLocn shapefile. These forms are used to enter vegetation data associated with a random site or infestation.

Collecting Habitat Parameters

- C. Now that you have found all the infestations along the trail, you will need return to the random sites and selected infestation sites to collect habitat data. To complete this process, follow the steps below. Steps are slightly different for random sites versus infestation sites because you have already collected some data for the infestation sites.

INFESTATION SITES

1. Under the drawing toolbar, select the [Selection] tool. Make certain you are still editing the [PlotLocn.shp] shapefile and tap on the infestation site where you want to collect additional data.
2. On the toolbar, tap on the [Feature Properties] button and this will bring up the form for the infestation.
3. The data under the LOCATION, SPECIES, and CREW tabs should already be populated so click on the MICROHABITAT tab.
4. Enter the estimated percent cover for all the fields listed below.
 - a. **Evergreen Cover**
 - b. **Deciduous Cover**
 - c. **Herbaceous Cover**
 - d. **Shrub Cover**
 - e. **Woody Debris Cover**

- f. **Litter Cover**
 - g. **Bare Ground Cover**
 - h. **Light Index**
5. Using the pick list, select one of the [**Veg Height**] classes. There are five potential classes.
 - a. 0.5-5 meters
 - b. 5.1-10 meters
 - c. 10.1-20 meters
 - d. 20.1-30 meters
 - e. >30 meters
 6. Enter the estimated percent cover for the remaining fields listed below.
 - a. **Soil Disturbance**
 - b. **Surface Water**
 7. Select the MACROHABITAT TAB and enter the following fields.
 - a. [**Slope**] as a percent
 - b. [**Aspect**] in degrees
 - c. Using the pick list, select the [**Macrohabitat**]. This field has five potential values.
 - (a) Top
 - (b) Up
 - (c) Mid
 - (d) Low
 - (e) Bottom
 - d. Using the pick list, select the [**Microhabitat**]. This field has four potential values.
 - (a) Convex
 - (b) Concave
 - (c) Straight
 - (d) Undulating
 - e. Using the pick list, select the [**Hydrology**]. This field has four potential values.
 - (a) Flooded Permanently
 - (b) Seasonally / Temporary Flooded
 - (c) Seep
 - (d) Upland
 - f. Using the pick list, select the [**LandUse**]. This field has nine potential values.
 - (a) Campground
 - (b) Cultivation
 - (c) Ditch / Diversion
 - (d) Graded
 - (e) Homestead
 - (f) Logging
 - (g) Mining
 - (h) Pasture
 - (i) Road / Trail
 - g. % of plot infested
 8. Select the TREATMENT TAB
 - a. The [Treatment] field should already be set; change it now if you decided to treat the site.

- b. The [Randomly Selected] field should already be set to “NO,” since you did select this site you will need to change this to “YES.”
 - c. Enter any [Visit Notes].
- 9. Click the ATTRIBUTE TAB and review the information you entered.
 - a. All the fields should be complete at this point (with maybe the exception of the notes field). This is one of the validation steps the crew is responsible for and should not be glossed over.

RANDOM SITES

1. Select the [PlotLocn.shp] shapefile using the same methods as described in Step 2 under the *Record the Start Date and Time* section of this document.
2. Walk into the middle of the random plot and tap the [**Capture GPS Point**] button under the Drawing Tool (Figure 3). This will open up a form that contains six tabs that will need to be completed. To complete this form, follow these steps.
 - a. Using the pick list, select the [**Route**] you are sampling.
 - b. Using the pick list, select the [**Segment**] where the species was found.
 - c. Select the [**GPS unit**] you are using to record the location information. Note: See the “GPS Capture Issues sections” below for information on EPE fields.
 - d. If the Trimble has satellite coverage, the [**PDOP**], [**Latitude**], and [**Longitude**] fields will automatically populate when you close the form.
 - e. Select the Species tab and use the pick list to enter the [**Encounter Class**]. There are two possible values:
 - (a) Infestation = A weed location
 - (b) Random = A random plot
 - f. Use the pick list to enter the [**Vegetation**]. There are two possible values:
 - (a) Yes = Vegetation data was collected at this site.
 - (b) No = Vegetation data was not collected at this site.
 - g. Using the pick list, select the [**Species**] you have observed.
 - h. Using the pick list, select the dominant [**Phenology**] of the invasive species. There are eight possible options.
 - (a) Bolting
 - (b) Bud
 - (c) Dead
 - (d) Flowering
 - (e) Mature
 - (f) Rosette
 - (g) Seed Set
 - (h) Seedling
 - i. Using the laser range finder, enter the [**Distance**] from the route to the center of the infestation in meters.
 - j. Estimate the [**Size**] of the infestation and use the pick list to enter the appropriate size. There are three size classes.
 - (a) <1 square meter
 - (b) 1-25 square meters
 - (c) >25 square meters
 - k. Select the CREW TAB and use the pick list to enter the name of the person recording the data on the Trimble unit.

- l. Use the pick list to enter the next most qualified crew member under the [**Crew 1**] field.
 - m. Use the pick list to enter the next most qualified crew member under the [**Crew 2**] field.
3. Click the MACROHABITAT TAB and enter the estimated percent cover for all the fields listed below.
 - a. **Evergreen Cover**
 - b. **Deciduous Cover**
 - c. **Herbaceous Cover**
 - d. **Shrub Cover**
 - e. **Woody Debris Cover**
 - f. **Litter Cover**
 - g. **Bare Ground Cover**
 - h. **Light Index**
4. Using the pick list, select one of the [**Veg Height**] classes. There are five potential classes.
 - a. 0.5-5 meters
 - b. 5.1-10 meters
 - c. 10.1-20 meters
 - d. 20.1-30 meters
 - e. >30 meters
5. Enter the estimated percent cover for the remaining fields listed below.
 - a. **Soil Disturbance**
 - b. **Surface Water**
6. Select the MACROHABITAT TAB and enter the following fields.
 - a. [**Slope**] as a percent
 - b. [**Aspect**] in degrees
 - c. Using the pick list, select the [**Macrohabitat**]. This field has five potential values.
 - (a) Top
 - (b) Up
 - (c) Mid
 - (d) Low
 - (e) Bottom
 - d. Using the pick list, select the [**Microhabitat**]. This field has four potential values.
 - (a) Convex
 - (b) Concave
 - (c) Straight
 - (d) Undulating
 - e. Using the pick list, select the [**Hydrology**]. This field has four potential values.
 - (a) Flooded Permanently
 - (b) Seasonally / Temporary Flooded
 - (c) Seep
 - (d) Upland
 - f. Using the pick list, select the [**LandUse**]. This field has nine potential values.
 - (a) Campground
 - (b) Cultivation

- (c) Ditch / Diversion
- (d) Graded
- (e) Homestead
- (f) Logging
- (g) Mining
- (h) Pasture
- (i) Road / Trail
- g. % of plot infested
- 7. Select the TREATMENT TAB
 - a. Select Yes or No if you did or did not [**Treat**] the site.
 - b. Select Yes under the [**Randomly Selected**] field because this was a randomly selected site.
 - c. Enter any [**Visit notes**].
- 8. Click the ATTRIBUTE tab and review the information you entered. This is one of the validation steps the crew is responsible for and should not be glossed over.
 - a. Once you have reviewed the information, click the green [**OK**] button at the bottom of the screen.
 - b. You can now move on to the next location where you plan on collecting habitat data.

Completing the Survey – END TIME

- D. You have now completed collecting data for all the infestation and random plots that you selected. Once you are back at the vehicle, you will need to record the end time of the survey. To do this, follow these steps.
 - 1. Make certain you are editing the “DateTime.shp” shapefile.
 - 2. Under the drawing toolbar, select the “Select Arrow.”
 - 3. Tap on the dot that you drew at the beginning of the survey.
 - 4. Tap on the “Feature Properties” button and this will open up the forms.
 - 5. The [Park] and [Route] fields should already be populated so click on the DATE / TIME TAB.
 - 6. The start date and start time should already be populated. All you need to do is enter the end time in the proper format.
 - 7. Once complete, click the green [OK] button at the bottom of the screen.
 - 8. You are now done with this survey and can return back to the vehicle.

Surveys that Take Two Days




- E. In most cases, surveys can be completed in 1 day. However, if a survey does take more than a day, you will need to add the date, start time, and end time for the second day. To do this, follow these steps.
 - 1. Make certain you are editing the “DateTime.shp” shapefile.
 - 2. Under the drawing toolbar, select the “Select Arrow.”
 - 3. Tap on the dot that you drew at the beginning of the survey the previous day.
 - 4. Tap on the “Feature Properties” button and this will open up the forms.
 - 5. The [Park] and [Route] fields should already be populated so click on the DATE / TIME TAB

6. The day two start date should be automatically populated with today's data. However, you still need to check the box next to the date or use the dropdown arrow which will open a calendar and allow you to enter a different date.
7. Enter the starting time in military format with no colons (e.g., 0825, 1215, 2244).
8. Complete the survey as described above.
9. Once done with the survey, under the drawing toolbar, select the "Select Arrow."
10. Tap on the dot that you drew at the beginning of the survey the previous day.
11. Tap on the "Feature Properties" button and this will open up the forms.
12. All fields should already be populated so all you need to do is enter the [End Time] for the second day.
13. Once complete, click the green [OK] button at the bottom of the screen.
14. You are now done with this survey and can return back to the vehicle.

Cannot Capture Satellites Using the Trimble Unit

- F. In a few cases, you may not be able to get good enough satellite coverage while standing in the middle of the random or infestation plot. There are two options at this point. The preferred option is to do an offset using the Trimble unit. The other option is to get the coordinates from the Garmin unit and then enter them into the Trimble unit. To do this, follow these steps.

Using an offset

1. If you cannot get a GPS signal, you need to use the Offset GPS  button.
 - a. Stand in an open area where you can get a GPS signal and can see the center of the weed infestation.
 - b. Click the [Offset GPS ] button.
 - c. Click the [Capture GPS Point ] button.
 - d. Look through the eyepiece of the rangefinder, make sure SD is selected at the bottom of the rangefinder screen, hold down the fire button, and remember the distance.
 - e. Use your compass to get a bearing from the location you are standing to the location of the weed.
 - f. Enter the bearing (from your compass) and the distance (in meters) from the rangefinder to the center of the infestation then click [OK] in the bottom right side of the screen.
2. If you still cannot get coverage, add the background NAIP imagery.
 - a. Click the [Draw Point] button.
 - b. Using the stylus, add a point to the map as close as possible to your known location.
 - c. When the Occurrence form opens, enter the coordinates from the Garmin unit into the proper latitude and longitude fields. Be sure to list "Garmin" in the GPS unit field on the field form.
3. If you cannot get satellite coverage with the Trimble OR Garmin unit, then follow steps 2 a and b, above. Just leave the hand drawn coordinates and be sure to list "Hand Drawn" in the GPS unit field.

Returning from the Field

Uploading the Data

Once you have collected the data in the field, you need to upload the data to the project database and validate the data to ensure their accuracy. To upload the data, open the project database on the laptop computer and place the Trimble unit into the cradle. Make sure ActiveSync begins to run and recognizes the handheld unit. Now follow the steps below to copy the data from the Trimble unit into the Access Database.

- A. Open up Microsoft Windows Explorer and go into the Mobile Device folder.
- B. Go to the Invasives folder on the Trimble unit and copy the [Data] folder.
 1. To copy, right click on the folder and select copy.
- C. Paste the folder in the Invasives_XX_XX (XX are the initials of the field crew)/GIS_Data/Backup/YYYYMMDD. Where YYYYMMDD is the name of a new folder you create named using the date you downloaded the data.
 1. To create the new folder, open up the backup folder and right click.
 2. Select new folder and then name the folder with today's date in the format YYYYMMDD.
- D. Go to the Invasives_XX_XX/GIS_Data/Template folder and copy all the files in this folder and paste them on the Trimble unit at Invasives/data folder. It will ask you if you want to do a replace; say yes. **NOTE:** This will erase any data on the Trimble Unit, so be sure you have properly completed steps A-C.
- E. Open the project database, which is located on your desktop in the Invasives_XX_XX/Project_Database folder.
- F. Click the [Administrative Tools] button and then click the [Data Upload] button.
- G. Using the browsers, browse to the DateTime.shp and PlotLocn.shp files you placed in the GIS folder in step C above. Then click the [Load Data] button.
- H. Click the [Click to Open QA/QC Report] button.
- I. Address any issues that were identified by the program (see QA/QC section below).
- J. Close the QA/QC report and click the tab called [Step 3: Upload Data].
- K. Click the [Click to Complete the Upload Process].
- L. Your data should now be uploaded to the database.

Entering Hardcopy Datasheets

In some cases, issues with the Trimble unit may prevent collecting data electronically. In this instance, you will need to use the hardcopy datasheet and enter the record into the project database by hand. This should be done as soon as you return from the field each night, unless otherwise directed. To enter the data into the project database, follow the steps listed below.

- A. Open the project database located on your desktop at:
Invasives_XX_XX/Project_Database.
- B. Click the [Enter/Edit Data] button.
- C. Complete the User Information as directed on the form and then select [OK].
- D. The filter is already turned on, so set the [Park] field to the name of the park where you collected the data you want to enter.
- E. Click the [Add New Record] button at the top of the form.
- F. Since this is a new location, click the [Add New] button next to the location field.
- G. Complete ALL fields on the location form and then select the [Close] button.

- H. Complete the Protocol Name, Start Date, Start Time, End Time fields.
- I. If there was a 2nd start date, enter this along with the appropriate times.
- J. Enter any visit information, if necessary.
- K. Using the picklist, enter the names of all the crew members and their roles. Keep in mind the person who recorded the data is the “Recorder” and all others are “Crew Members.”
- L. In the middle of the form, make sure the MACRO HABITAT TAB is selected and complete all the fields on this form.
- M. Next, click the MICRO HABITAT TAB and complete all these fields.
- N. Once done, either click the [New Record] button if you have another record to enter or click the [Close] button if you are done entering data.
- O. If you are done, you should now see the record in the list of records on the Data Gateway form. Click the [Close] button on this form.
- P. When you are done adding records or editing a record, click the [Back up data] button. A message will appear asking you if you want to backup the database; click [YES].
- Q. In the project folder on your desktop browse to Invasive_XX_XX/Project_Database/Backup and save a copy of the database. Be sure to use the default name.
- R. Close the database. You are done.

Verifying the Data

Now that you have loaded the data into the database, you need to go into each record in the database and make sure they match the hardcopy forms. If no hardcopy forms are available, you still need to review the data to make certain all the fields have been populated. To do this, follow the steps listed below:

- A. If the database is not already open, open the project database located on your desktop at: Invasives_XX_XX/Project_Database.
- B. Click the [Enter/Edit Data] button.
- C. Complete the User Information as directed on the form and the select [OK].
- D. The filter is already turned on, so set the [Park] field to the name of the park where you collected the data you want to enter. You should now see a list of all the sites (infestations and random sites) located in the database.
- E. Double click on the visit date for a record will open the record.
- F. Review all the fields on the form including the three tabs in the middle of the form. Make revisions as necessary.
- G. Close the form and repeat steps E-G until all the records have been reviewed.
- H. If changes were made, make a backup of the database following steps P-R in the section above.

You are now done verifying the data and it is ready to be reviewed by the Project Manager and/or the Crew Leader.

NOTE: If you have followed the steps above, you now have black shapefiles on your Trimble unit and a clean, verified dataset on your laptop computer. Do not put old shapefiles on the Trimble unit because they will contain data that have not been reviewed.

Validating the Data

Once the field crew has finished sampling a park, and if there are multiple crews, the Crew Lead should collect each database and give it to the Data Manager. The Data Manager will combine the databases and provide the Crew Lead with one database that contains all the data from that park. The Crew Lead is responsible for another round of data validation and verification. The Crew Lead should examine the digital records and compare them to the hardcopy forms. Errors should be addressed immediately. If they cannot be addressed, they should be documented explaining the error. Errors on datasheets should be corrected using a red pen. In addition to the database, the Crew Lead should look at the data in the database and by using ArcGIS to make sure the data make sense and “look” correct (sites are in the correct spots, no outliers, etc.).